8

Lower Devonian Conodonts From Loyola, Victoria

By B. J. Cooper*

Abstract: Nineteen disjunct conodont species are recorded from the limestones at Loyola, near Mansfield, Victoria. One new taxon, *Spathognathodus trilinearis* is proposed. The conodont faunas suggest an age close to the base of the Emsian. Correlations are made with conodont faunas previously described from the Coopers Creek Formation and the Lilydale Limestone.

INTRODUCTION

The Loyola limestones are exposed at Loyola, about 200 km NE. of Melbourne and 11 km SW. of Mansfield. Almost all previous geological studies in the area have concentrated on the phosphate or limestone deposits and their associated fossils.

The first reference to the limestone was made by Couchman (1887), with preliminary identification of the fossil content. Subsequent important contributions to the palaeontology include studies on its corals (Hill 1939, Pedder 1967a, 1967b) and stromatoporoids (Ripper 1938).

Howitt (1906, 1923) in his study of the phosphate deposits, mapped the approximate positions of the Old Lime Kiln, Griffiths Quarry and Howes Valley limestone deposits. Bell (1955) mapped all four outcrops and recognized their limited extent.

Fossils from the mudstones associated with the limestones have been described by Chapman (1914, 1915, 1916), Gill (1951, 1969) and Boucot et al (1966).

The present paper deals with the description and stratigraphic significance of the conodont faunas found in the limestones.

STRATIGRAPHY

The area under consideration contains a marine sequence through part of the Lower Devonian. Broad extrapolation along strike from the Jamieson area has led most writers to correlate the Loyola limestones with the 'basal conglomerates' of the Walhalla Group on the eastern margin of the Walhalla synclinorium (Talent 1965, Bell 1955).

In the current investigation, fossiliferous grits and conglomerates were located about 500 m above the limestones at Loyola. These are probably the local equivalent of the Walhalla 'basal conglomerates'.

The limestone itself outcrops in four small lenses. These are shown on Fig. 1 and are described in the Appendix. The separate lenses are approximately aligned along strike and apparently represent discrete carbonate accumulations developed at a particular horizon and separated by terrigenous sediments.

THE CONODONT FAUNA

All four limestone lenses at Loyola were sampled for conodonts and the following amounts processed: Cummins Road limestone 1 kg, Old Lime Kiln 36 kg, Griffiths Quarry 51 kg, Howes Valley limestone 4 kg. Due to the nature of the exposure, sampling at the Cummins Road deposit was restricted. The Howes Valley limestone proved to be barren.

In all about 160 identifiable conodonts were recovered by digestion in acetic acid, followed by separation in tetrabromoethane adjusted to a specific gravity of 2·75. These included the following form species:

Belodella devonica (Stauffer 1940)
B. resima (Philip 1965)
B. triangularis (Stauffer 1940)
Drepanodus sp.
Hindeodella priscilla Stauffer 1938
Neoprioniodus bicurvatus (Branson and Mehl 1933)
Ozarkodina denckmanni Ziegler 1956
O. media Wallisei 1957

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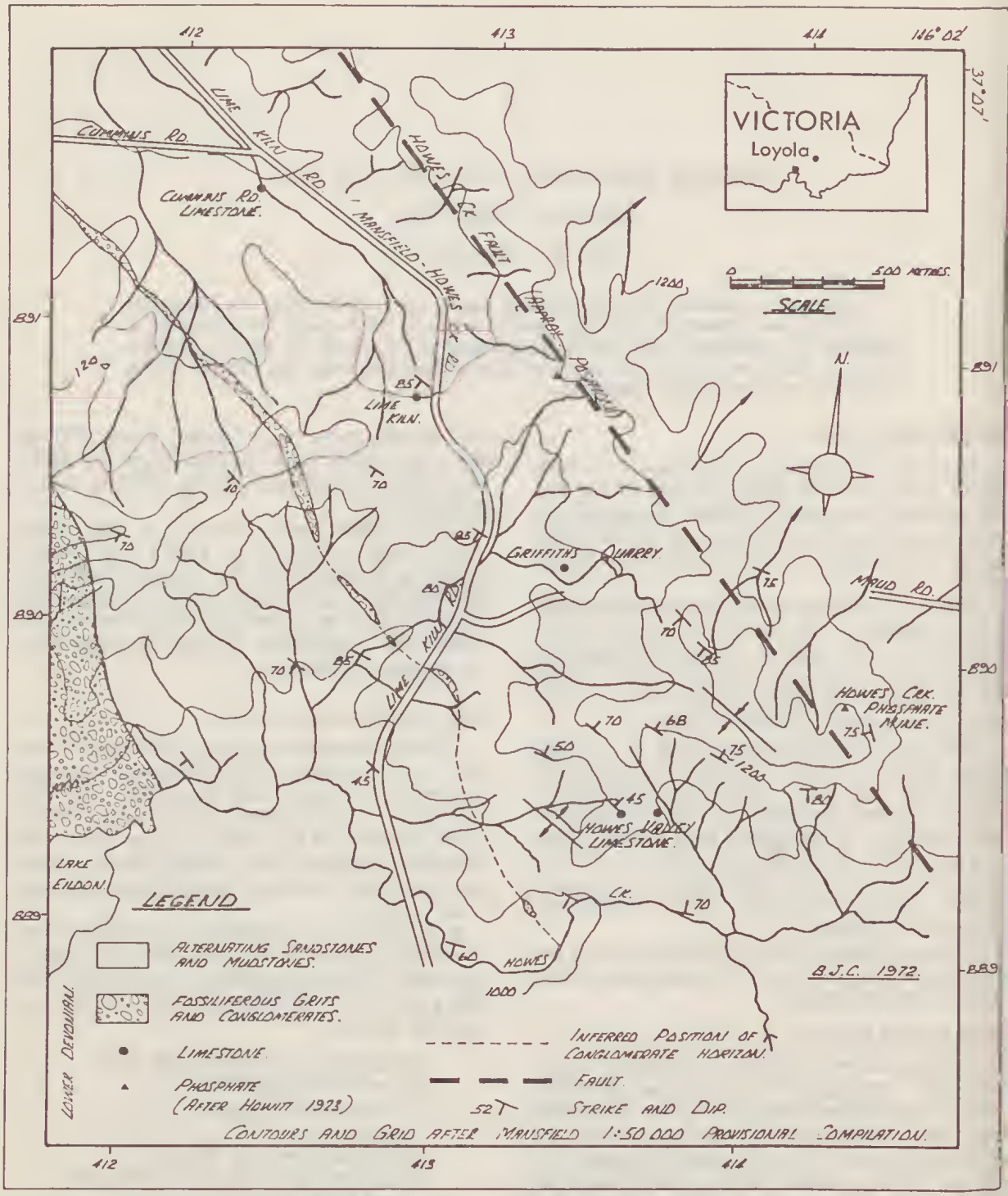

FIG. 1—Map showing Location of the Loyola limestones.

Panderodus simplex (Branson and Mehl 1933)
P. unicostatus (Branson and Mehl 1933)
Polygnathus sp.
Scolopodus sp. A
S. sp. B
Spathognathodus inclinatus inclinatus (Rhodes 1953)
S. steinhornensis cf. *buchanensis* Philip 1966
S. trilinearis sp. nov.
Trichonodella inconstans Walliser 1957
T. cf. *pinnula* Philip 1966
T. symmetrica (Branson and Mehl 1933)

AGE AND CORRELATION OF THE LIMESTONE AT LOYOLA

In the Lower Devonian limestones of Australia Philip and Pedder (1967b, 1967c) recognized a sequence based on tetracorals and conodonts.

The faunas most relevant to the Loyola limestone are:

FAUNA B (*Lyrielasma chapmani* fauna), characterized by the conodont *Spathognathodus sulcatus* (Philip 1965).

Type Locality—Coopers Creek Formation, Tyers, Vic.

FAUNA C (*Zelolasma gemmiforme* fauna), characterized by the conodont *Polygnathus dehiscens* Philip and Jaekson 1967.

Type Locality—Cavan Limestone, Taemas, N.S.W.

Philip and Pedder (1967a, 1967b) recorded *Spathognathodus sulcatus* (Philip) (= *Eognathodus sulcatus*) from Loyola and concluded that the limestones belong to the Fauna B horizon.

Conodonts recovered in the present study do not include *S. sulcatus* but a closely related form, *Spathognathodus trilinearis*, has been recognized.

The discovery of a polygnathid at Loyola strongly suggests affinities to Fauna C. In addition, the occurrence of forms almost identical to *Spathognathodus steinhornensis buchanensis* Philip suggest an age younger than Fauna B.

Hence, on the basis of the faunas established by Philip and Pedder (1967b), the Loyola limestone may be assigned to Fauna C.

In relating the Australian sequence to the Rhenish standard, Philip and Pedder (1967a) have maintained an Early Siegenian age for Fauna B and a Late Siegenian age for Fauna C. The elucidation of a sequence of conodont zones by Klapper (1969) in the Lower Devonian of Western North America have indicated that these conclusions should be re-assessed. Klapper's sequence can be accurately related to a series of brachiopod faunas, which are confidently correlated with the Rhenish type in Europe (Johnson et al 1967, Johnson 1970).

The range of *S. sulcatus* is limited by Klapper to the Middle and Upper Siegenian. The recognition of an older and younger form is based on the size of the basal cavity. Following Klapper, Fauna B would be Middle or Upper Siegenian in age.

Again, according to Klapper (1969) the oldest polygnathid, *P. dehiscens* Philip and Jaekson 1970 (= *P. lenzi*) first appears well above the Siegenian/Emsian boundary. Fahraeus (1971) records the discovery of slightly older polygnathids in Nevada, but still within the Emsian. In this framework, Fauna C would be assigned to the Lower Emsian.

The new form, *Spathognathodus trilinearis*, described herein is also important. Specimens of *S. sulcatus* from Tyers, Victoria, approaching this form have been illustrated by Philip (1965 Pl. 10, fig. 25), and Klapper (1969 p. 23) notes similar forms in the Upper Siegenian at Royal Creek, Yukon, Canada.

The Loyola fauna is therefore probably Early Emsian in age, most probably the basal Emsian.

Conodonts from the Lilydale Limestone have been listed and figured by Philip and Pedder (1967a). Unpublished studies by the author indicate that their *Spathognathodus steinhornensis* Ziegler is, in fact, *Spathognathodus philipi* Druce 1970, which is almost identical to *Spathognathodus johnsoni* Klapper 1969. In North America, *S. johnsoni* is indicative of a Lower Siegenian age. With the Middle/Upper Siegenian and Fauna B conodont *Spathognathodus sulcatus* also present at Lilydale, a Lower to Middle Siegenian age is recognized.

Overall then, it can be shown that of the conodont faunas now described from Yeringian limestones, the Lilydale fauna is probably the oldest, followed by the Coopers Creek Formation, at the type locality for Fauna B. The youngest fauna, described herein, is from the Loyola limestone.

SYSTEMATIC DESCRIPTIONS

As the conodont fauna at Loyola was not large, no attempt at recognizing natural conodont species was possible. The following descriptions are therefore based on form taxonomy still used by many workers.

Most of the conodonts recognized at Loyola were well-known Lower Devonian forms, so descriptions of stratigraphically important and lesser known elements only are given.

All specimens are stored in the University of Melbourne, School of Geology Fossil Slide Collection (MUGD.FS).

Genus **Polygnathus** Hinde 1879
Type species: **Polygnathus dubia** Hinde 1879

Polygnathus sp.
(Pl. 2, fig. 3, 4, 5)

DESCRIPTION: A *Polygnathus* having carinae and transverse ridges discernible on the platform. The platform tapers posteriorly and is flexed downward. A prominent basal cavity is present on the aboral surface beneath the platform with grooves extending along the remainder of the unit.
REMARKS: The fragmental and weathered nature of the material prevents positive identification. However, the Loyola form is probably *Polygnathus dehiscens* Philip and Jackson 1970.
MATERIAL: 2 specimens.

Genus **Scolopodus** Pander 1856
Type species: **Scolopodus sublaevis** Pander 1856

REMARKS: *Scolopodus* includes multicostate cones, which are known mainly in Ordovician faunas. However through the years occasional occurrences have been recorded from Devonian strata (Sannemann 1955, Bischoff & Sannemann 1958, Ethington et al 1961, Clark & Ethington 1966). Schulze (1968) correctly suggested that such conodonts were not related to Ordovician forms and went on to describe a lineage from *Scolopodus* to *Icriodus* by way of the intermediate genus *Pelekysgnathus*. Klapper and Philip (1971) recognized these three form genera to be part of their Type 4 Apparatuses. *Scolopodus* appears to be rare in all Devonian faunas so far described. Open taxonomy is used in the two forms described here.

Scolopodus sp. A
(Pl. 2, fig. 10, 14)

DESCRIPTION: A species of *Scolopodus* with a gently curved anterior margin. Due to the basal expansion of the unit, the posterior margin is directed anteriorly near the base, followed by a sharp turn posteriorly further up the unit.

The base is poorly elliptical in cross section with one side expanded more than the other. The anterior margin is sharp edged, while the posterior margin has a rounded outline.

The ribs and grooves so characteristic of scolopodids split into a succession of smaller ridges as they approach the expanded base, especially near the anterior margin. All decoration disappears, before reaching the base.
REMARKS: This specimen most closely resembles *Scolopodus devonicus* Bischoff and Sannemann. However, the cross section of the base lacks good symmetry and the anterior margin has less curvature.
MATERIAL: 1 specimen.

Scolopodus sp. B
(Pl. 2, fig. 11, 13)

DESCRIPTION: A species of *Scolopodus* with gently curved anterior and posterior margins. The whole unit has a sub-circular cross section and is expanded slightly at the base. The external ribbing extends almost to the basal margin, but does not subdivide as in *Scolopodus* sp. A.
REMARKS: The specimen appears to resemble *Scolopodus* sp. (Clark and Ethington 1966), but no illustration accompanies their description. Unfortunately the single specimen found at Loyola was lost, but the form is recorded here for the sake of completeness.

Genus **Spathognathodus** Branson and Mehl 1941
Type species: **Ctenognathus murchisoni** Pander 1856

Spathognathodus steinhornensis cf. **buchanensis** Philip 1966
(Pl. 2, fig. 8, 9, 12; Pl. 2, fig. 2, 3, 4, 5)

cf. *Spathognathodus steinhornensis buchanensis* Philip 1966, p. 450, Pl. 2, fig. 1-15, non fig. 15-28.
cf. *Spathognathodus steinhornensis optimus* Moskalenko 1966, Pedder et al 1970, p. 218, Pl. 38, fig. 4-6, non fig. 7, 10-12.
DESCRIPTION: A *S. steinhornensis* which possesses rather coarse variable denticulation. The basal cavity varies in position, but is usually situated in the central third of the unit. The lateral lobes are slightly asymmetrical.
REMARKS: Pedder et al (1970) believe that *S. steinhornensis buchanensis* is identical with *Spathognathodus optimus* Moskalenko. However, the present writer feels that only the younger form of *S. steinhornensis buchanensis* from the Murrindal Limestone is synonymous, while the older variety from the Buchan Caves Limestone is retained as a separate taxon.

The Loyola specimens differ from ordinary *S. steinhornensis buchanensis* in having greater variation in the position of the basal cavity. They closely resemble *S. steinhornensis eosteinhornensis* (Walliser 1964, Pl. 9, fig. 15; Pl. 20, fig. 7-16, 19-25).
MATERIAL: 36 specimens.

Spathognathodus trilinearis sp. nov.
(Pl. 3, fig. 1, 6, 7)

DERIVATION OF NAME: From L., *tria* = three together, *linearis* = of a line.
DIAGNOSIS: A species of *Spathognathodus* with three rows of denticles in the posterior part of the unit..
TYPE SPECIMENS: Holotype MUGD.FS 1698/15, paratypes MUGD.FS 1698/16, 1698/14, 1714/16.
DESCRIPTION: The unit has a higher anterior blade, which progressively decreases in height towards the 'platform' or three-rowed portion. These anterior denticles are usually aligned with one of the outside rows of nodes on the platform.

The platform does not taper to any great degree in the far posterior of the unit and the troughs between each row of nodes are shallow.

In lateral and aboral views, the species is identical with *Spathognathodus sulcatus* and related forms. The basal cavity is wide and asymmetrical.
REMARKS: This species, together with *Spathognathodus sulcatus* (Philip), *Spathognathodus secus* (Philip), *Spathognathodus linearis* (Philip) and *Spathognathodus irregularis* (Druce), would have been placed in a

separate genus, *Eognathodus* by other workers; see Philip (1965, 1966) and Druce (1970). However, the present writer believes that these forms lie within the diagnosis of *Spathognathodus*, even though the group concerned constitutes an important, closely related branch of the main spathognathodid stock.

It has long been recognized that the genus *Polygnathus* must have derived from *Spathognathodus* sometime in the Lower Devonian (Lindstrom 1964, p. 48). The species described here is the closest recorded spathognathodid to this genus and indicates the the *S. sulcatus* group gave rise to polygnathids at about this time.

The principal differences between *S. trilinearis* and the earliest polgnathids are:

1. The continuity of the anterior blade with one of the outer rows of nodes on the platform.
2. The prominent flaring lobes surrounding the basal cavity.

MATERIAL: 4 specimens.

Genus **Trichonodella** Branson and Mehl 1948
Type species: **Trichognathus prima** Branson and Mehl 1933

Trichonodella cf. **pinnula** Philip 1966
(Pl. 3, fig. 10)

REMARKS: The specimen from Loyola differs from type material in the Buchan Caves Limestone (Philip 1966) in having smaller limb divergence (70°–80°) and longer limbs. However, the laterally flattened cusp and recurved limbs can be easily distinguished.

MATERIAL: 1 specimen.

ACKNOWLEDGMENTS

Dr. G. A. Thomas, Mr. T. A. Darragh and Mr. C. W. Mallett of the School of Geology, University of Melbourne, critically read and suggested many improvements to the manuscript. Mr. R. Britten assisted in the work carried out using the Scanning Electron Microscope.

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APPENDIX

LOCATION OF THE LIMESTONES AT LOYOLA

Previous references to the Loyola limestones are based on a parish plan pre-dating the completion of Lake Eildon. Hence, the deposits are here clearly defined and their location re-described in relation to present roads.

The allotment numbers refer to the Loyola Parish Plan, County of Delatite 1923.

The Grid References (G.R.) are based on 1:50,000 Provisional Compilation for Mansfield.

1. Cummins Road limestone, (G.R. 89134122), near NE. boundary of Allotment 94 or approximately 100 m SE. of the intersection of Cummins and Lime Kiln Roads.

2. Old Lime Kiln, (G.R. 89084127), small quarry with abandoned lime kiln in the SE. corner of Allotment 94 on the western side of Lime Kiln Road, south of Cummins Road.

3. Griffiths Quarry, (G.R. 89034133), quarry in Allotment 132E, filled with water. It is some distance E. of Lime Kiln Road and can be reached via a track leaving the main road.

4. Howes Valley limestone (G.R. 88954137), near western boundary of Allotment 133, almost a km E. of Lime Kiln Road. The limestone occurs in several outcrops on both sides of a ridge, interbedded with fossiliferous mudstones.

EXPLANATION OF PLATES

(All specimens illustrated were photographed using a Graflex camera, having an SM3-CSI attachment on a J.E.O.L. JSM-U3 Scanning Electron Microscope.)

Plate 2

Fig. 1—*Hindeodella priscilla* Stauffer 1933. Lateral view of MUGD.FS 1692/15, Old Lime Kiln, × 60.

Fig. 2—*Drepanodus* sp. Lateral view of MUGD-FS 1695/15, Old Lime Kiln, × 60.

Fig. 3-5—*Polygnathus* sp. (3) Oral view of MUGD.FS 1710/14, × 60. (4) Oral view of MUGD.FS 1710/16, × 60. (5) Aboral view of MUGD.FS 1710/16. × 60. Both specimens from Griffiths Quarry.

Fig. 6—*Belodella resima* (Philip 1965). Lateral view of MUGD.FS 1688/21, Old Lime Kiln, × 60.

Fig. 7—*Ozarkodina denckmanni* Ziegler 1956. Lateral view of MUGD.FS 1694/16, × 60, Old Lime Kiln.

Fig. 8, 9, 12—*Spathognathodus steinhornensis* cf. *buchanensis* Philip 1966. (8) Lateral view of MUGD.FS 1698/18, × 60. (9) Lateral view of MUGD.FS 1697/15, × 60. (12) Aboral view of MUGD.FS 1696/15 × 60. All specimens from the Old Lime Kiln.

Fig. 10, 14—*Scolopodus* sp. A. Lateral view of MUGD.FS 1711/16, × 60 and × 200, Griffiths Quarry.

Fig. 11, 13—*Scolopodus* sp. B. Lateral view, × 60 and × 200, Griffiths Quarry.

Plate 3

Fig. 1, 6, 7—*Spathognathodus trilinearis* sp. nov. Lateral, oral and aboral view of holotype. MUGD.FS 1698/15, × 60, Old Lime Kiln.

Fig. 2-5—*Spathognathodus steinhornensis* cf. *buchanensis* Philip 1966. (2) Lateral view of MUGD.FS 1713/18, × 60, Griffiths Quarry. (3) Lateral view of MUGD.FS 1713/16, × 60, Griffiths Quarry. (4) Aboral view of MUGD.FS 1713/16, × 60, Griffiths Quarry. (5) Lateral view of MUGD.FS 1696/15, × 60, Old Lime Kiln.

Fig. 8—*Trichonodella symmetrica* (Branson and Mehl 1933). Lateral view of MUGD.FS 1701/13, × 40, Old Lime Kiln.

Fig. 9, 11—*Trichonodella inconstans* Walliser 1957. Lateral views of MUGD.FS 1699/16, × 60 and MUGD.FS 1699/12, × 40. Both specimens from the Old Lime Kiln.

Fig. 10—*Trichonodella* cf. *pinnula* Philip 1966. Lateral view of MUGD.FS 1691/16, = 120, Old Lime Kiln.